



Delaware Division of Watershed Stewardship Nonpoint Source Program



2018 ANNUAL REPORT

DELAWARE DEPARTMENT OF NATURAL RESOURCES
AND ENVIRONMENTAL CONTROL

89 Kings Highway Dover, DE 19901

Phone: 302-739-9922

<https://dnrec.alpha.delaware.gov/>



The Delaware Nonpoint Source Program administers a competitive grant made possible through Section 319 of the Clean Water Act. The grant provides funding for projects designed to reduce nonpoint source (NPS) pollution in Delaware. NPS pollution may be defined as any pollution that originates from a diffuse source (such as an open field or a road) and is transported to surface or ground waters through leaching or runoff. Reduction of NPS pollution may often be achieved through incorporation of specific best management practices (BMPs) into project workplans. Projects may target any source of NPS pollution, but most frequently involve agriculture, silviculture, construction, marinas, septic systems, and hydromodification activities.

In addition to funding projects that achieve reductions in NPS pollution, the Delaware NPS Program is committed to addressing the issue through educational programs, publications, and partnerships with other organizations working to reduce NPS pollution in Delaware.

Program Staff:

Marcia Fox, Program Manager
Sharon Webb, Environmental Scientist
Brittany Sturgis, Environmental Scientist
Tyler Monteith, Environmental Scientist
Clare Sevcik, Environmental Scientist
Mark Hogan, Planner
James Sullivan, Planner
Lori Brown, Planner
Vacant, CREP Coordinator
Philip Miller, Marketing Specialist
Brenda Zeiters, Administrative Specialist

Published and Distributed by the:

Delaware Nonpoint Source Program
DNREC, Division of Watershed Stewardship
89 Kings Highway
Dover, DE 19901
Telephone: (302) 739-9922
Fax: (302) 739-8017

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Preface

The 2018 Delaware NPS Report is developed by the Delaware Department of Natural Resources and Environmental Control (DNREC) to meet a grant condition that appears in each annual 319(h) Grant award to the State of Delaware from the U.S. Environmental Protection Agency. This programmatic condition in the award states, the report shall contain the following:

- a brief summary of progress in meeting the schedule of milestones in the approved Management Program,
- reductions in nonpoint source pollutant loading and improvements in water quality that has resulted from implementation of the Management Program, and
- descriptions of priority Watershed Based Plan accomplishments. Accomplishments should be based on the implementation milestone goals/objectives as identified in each priority plan. The goal information can be displayed in the form of a watershed goal/accomplishment chart showing percent achieved, supplemented by a short narrative that should give the reader a clear understanding of the actions being taken and the outputs and outcomes which are occurring from the actions. If monitoring was completed, a summary of that information should also be included. For example, if 1000 feet of streambank stabilization was completed, then how does that compare to the needs identified in the watershed based plan (i.e. what percent of streambank stabilization was completed compared to the overall needs as identified by the plan). Similar comparisons should also be provided for each significant pollutant load reduction.

What is Nonpoint Source Pollution?

Nonpoint source (NPS) pollution is defined as polluted stormwater runoff associated with rainfall, snowmelt, or irrigation water moving over and through the ground. As this water moves, it picks up and carries pollutants with it, such as sediments, nutrients, toxics, and pathogens. These pollutants eventually reach lakes, rivers, wetlands, coastal waters, and ground waters of Delaware.

NPS pollution is associated with a variety of activities on the land, including farming, logging, urban/construction runoff, onsite sewage systems, streambank degradation, shore erosion, and others. For example, stormwater flowing off the land carries the nutrients nitrogen and phosphorus into local streams, rivers, and ponds. Under natural conditions, this is beneficial. However, if excessive nutrients enter these water bodies and cause nuisance algae blooms, then these nutrients are deemed pollutants.

The pollution contributed by nonpoint sources is the main reason why many of Delaware's waters are considered "impaired." Impaired waters are those waters that do not meet Water Quality Standards for designated uses (e.g., fishing, swimming, drinking water, shellfish harvesting, etc.). Progress in managing NPS pollution in Delaware is represented in this report. It was produced by the Department of Natural Resources and Environmental Control (DNREC) NPS Program to meet Clean Water Act, Section 319(h) Grant conditions and to demonstrate



consistency with EPA's 2018-2022 Strategic Plan. The main area of EPA's Strategic Plan in which Delaware focuses its work is Goal 1: Core Mission: Deliver real results to provide Americans with clean air, land and water and ensure chemical safety, Objective 1.2 Provide for Clean and Safe Water.

I. The Delaware NPS Program

As part of the DNREC, the Delaware NPS Program is committed to addressing the issue of NPS pollution as it affects Delaware's numerous waterbodies. Efforts include grant funding, education, outreach, and partnerships with other organizations working together to reduce NPS pollution in Delaware.

II. NPS Program Funding

Nonpoint Source (NPS) pollution constitutes the nation's largest source of water quality problems. Approximately 40 percent of the United States rivers, lakes, and estuaries surveyed to date are not clean enough to meet basic uses, such as fishing or swimming, due to NPS pollution.

To counter the ever expanding nonpoint source pollution problem, Congress established the NPS Pollution Management Program under Section 319 of the Clean Water Act (CWA) in 1987. This program provides States with grants to implement NPS pollution controls to achieve goals that are described in NPS pollution management program plans.

On August 4, 1988, Delaware's original NPS Program was approved by the Environmental Protection Agency (EPA), making it one of the first programs in the nation to comply with Section 319 of the CWA. Using CWA Section 319 funding, Delaware's NPS Program administers a competitive grant program. The grant provides funding for projects designed to reduce NPS pollution in Delaware's impaired waterbodies. Reduction of NPS pollution is most often achieved through incorporation of specific best management practices (BMPs) into project workplans. Whenever possible, funds are focused in sub-watersheds where NPS control activities are likely to have the greatest positive impact. Funded restoration activities are implemented using the most effective measures and practices available in order to achieve water quality improvements. Eligible types of management program implementation activities include the following:

- Non-regulatory NPS reduction programs
- Technical assistance
- Financial assistance
- Education
- Training
- Technology transfer
- Demonstration projects

Proposals are requested annually, reviewed, evaluated, and prioritized, and those which are determined to meet specified requirements are eligible for funding. At least 40 percent of the overall project cost must be represented by non-federal matching funds.

III. Delaware NPS Issues

More than 90 percent of Delaware's waterways are considered impaired. The State's list of impaired waters in [*2018 Draft Combined 305\(b\) and 303\(d\) report*](#), includes 397 assessment units (waterbodies and stream segments) with 10 different impairments, the most common of which are NPS related pollutants including pathogens and nutrients (nitrogen and phosphorus). Most impairments come from nonpoint sources, which are harder to control. As Delaware is a groundwater driven State, removing NPS pollutants becomes an even harder problem to solve. Due to the rate that groundwater travels through the system, many NPS pollutants that entered the systems 30 years ago are just now entering surface water bodies today. As such, the effectiveness of current agricultural BMPs will not be realized until much further in the future.

"Impaired waters" are polluted waters. More technically, they are waters that do not meet water-quality standards for their designated uses, such as recreation, fishing, or drinking. Impaired waters could be suffering from excess nutrients, low dissolved oxygen, toxins, bacteria, heat, or any combination of these problems.

Reduction of NPS pollution is achieved through the incorporation or installation of specific best management practices (BMPs) addressing agriculture, silviculture, construction, septic systems, and hydromodification activities. To encourage and support the BMP installation, the NPS Program administers a competitive grant program currently made possible through Section 319 of the Clean Water Act. While this federal financial support has proven successful in complementing Delaware's NPS efforts, the NPS Program is currently seeking additional finances to expand activities to more systematically address Delaware's NPS concerns.

Additional roles and responsibilities of the NPS Program include geospatial BMP tracking and reporting, management of the agricultural State Revolving Fund Program, support for developing Pollution Control Strategies, and watershed plan development and/or coordination.

IV. Vision and Mission

The Department of Natural Resources and Environmental Control (DNREC) envisions a Delaware that offers a healthy environment where people are committed to the protection, enhancement, and enjoyment of the environment; where Delawareans' stewardship of natural resources ensures the sustainability of these resources for the appreciation and enjoyment of future generations; and where people recognize that a healthy environment and a strong economy support one another.

It's the mission of the Delaware DNREC to protect and manage the State's vital natural resources, protect public health and safety, provide quality outdoor recreation, and to serve and educate the citizens of the First State about the wise use, conservation, and enhancement of Delaware's Environment.

The Nonpoint Source (NPS) Management Program is a dynamic and open-ended program intended to facilitate and promote statewide efforts to manage NPS pollution. The following priorities will guide this program:

1. The NPS Program will support the identification and quantification of those problems that are caused specifically by NPS pollution through assessment updates.
2. The NPS Program will be implemented and updated to realistically reduce NPS pollution in a cost-effective manner.
3. The NPS Program will address NPS pollution through a program that balances education, research, technical assistance, financial incentives, and regulation.
4. The NPS Program will follow a non-degradation policy in areas where surface and ground waters meet State water quality standards and to realistically improve water quality in areas that do not meet these standards.
5. The NPS Program will continue to use the coordinated approach for implementation and maintain an open ended framework to incorporate new initiatives and support interactive approaches based on the effectiveness of existing policies and implementation mechanisms.
6. The NPS Program will support the development and implementation of Watershed Restoration Action Strategies (WRAS)/Pollution Control Strategies (PCS) for watersheds of identified impaired or threatened waters in accordance with the Unified Watershed Assessment List.

In Delaware, the lead agency for the development and implementation of the Nonpoint Source (NPS) 319 Program is the DNREC, Division of Watershed Stewardship.

V. Executive Summary

The Delaware Nonpoint Source (NPS) Program has focused this annual report on nine priority watersheds in Delaware – Upper Chesapeake, Chester and Choptank, Nanticoke, Pocomoke and Wicomico, Christina Basin, Appoquinimink River, Broadkill River, Inland Bays, and St. Jones River. All suffer from impairments linked to NPS water pollution.

In 2018, the Delaware NPS Program received \$1.15M in federal section 319(h) grant funds to focus on nonpoint source water pollution reduction efforts. This annual report documents the activities and highlights of the State of Delaware, Department of Natural Resources and Environmental Control's (DNREC) Nonpoint Source (NPS) Program during the 2018 calendar year. It also fulfills the requirements of Section 319 of the federal Clean Water Act. DNREC's NPS Program annually prepares this report to inform stakeholders on the state's progress in the area of nonpoint source water pollution reduction. Although this report should not be considered a complete enumeration of all nonpoint source pollution reduction activities, it describes the most important features and accomplishments of the NPS Program.

In 2018, the Delaware NPS Program continued to reduce water pollutant levels by achieving milestone targets. Milestone targets are near-term or long-term commitments that promote a steady pace of progress towards water quality improvement. This report identifies several accomplishments during the 2018 calendar year that helped Delaware achieve long-term and short-term milestones (Appendix A), all of which have been identified in the State's NPS Management Program. Milestone activities successfully implemented during 2018 to support and/or enhance the program include: providing grant funding, education and outreach, and enhancing partnerships with other organizations to work together to reduce nonpoint source pollution in Delaware.

- **Grant funding** – In 2018, the Delaware NPS Program received \$1.1M in federal section 319(h) grant funds to focus on nonpoint source pollution reduction efforts. Grant funding was used and leveraged to implement pollutant control projects, best management practices, and actions featured in the table below.
- **Education and Outreach** – Delaware's NPS Program attended several educational and outreach events across the State including Coast Day in Lewes, Blackbird Fall Festival in Odessa, and the State Fair in Harrington. The Program held a photo contest where photographers across the state participated in the first Delaware Watersheds Photo Contest, which aims to share the beauty of Delaware's diverse environment while acting as a vivid reminder that everything that happens on land within the state's watersheds also directly affects what's happening in our waterways. Over 400 entries were received and winning photos are featured in this report.
- **Partnerships** – A highlight of 2018 for the Delaware NPS Program was the revitalization of partnerships at the 2018 Nonpoint Source Advisory Committee Meeting in Lewes. Over 50 partners attended from across the State to present on grant projects and discuss water quality issues. Additionally, the Program worked with partners to update the 2019

NPS Management Plan, NPS Strategic Plan, and Phase III Chesapeake Bay Watershed Implementation Plan. Also, staff provided input during the National Estuary Program's Comprehensive Conservation Management Plan updates.

Overall, the NPS Program funded projects that were completed during the calendar year resulting in pollutant load reductions of nitrogen at 1,351,589pounds/year and phosphorus at 51,566 pounds/year (see table below). Delaware continues to ensure that projects funded with CWA Section 319 dollars make progress towards restoring or protecting waters impaired by NPS pollution.

Pollutant Controls, Practices, and Actions	Unit	2018 Annual Progress
Cover Crop (traditional and commodity)	acres	61,607
Nutrient Relocation (net export from watershed)	tons	42,057
Nutrient Management	acres	88,208
Tree Planting	acres	32
Water Control Structures	Acres	1,742
Stream Restoration	Feet	9,621
Wetland Restoration	Acres	2,756

VI. Watersheds



Delaware Nonpoint Source Program 2018 Watershed Progress Report

Appoquinimink River

Appoquinimink River Watershed

Legend:

- Water
- Tidal Headwaters/Wetlands
- Municipality
- Watershed

Scale: 0 to 2 Miles

Progress Highlights: All sectors have taken steps (the implementation of laws, regulations, and voluntary BMPs) to improve water quality. Analysis using a basic land use loading rate model shows nonpoint sources of TN and TP have been reduced by 109% and 111%, respectively, from TMDL baseline levels. There is still a need for further reductions in areas such as wastewater and stormwater.

TP:  TN:  TSS: 

BMP Progress FY 2018							
BMP Name	Units	2018 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice & N Load Reductions (lbs/year)	Practice & P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	4,714	Annual	3,145	150	71,789	138
Nutrient Management	Acres	4,620	Annual	12,854	36%	15,479	744
Riparian Buffer (forest and vegetative)	Acres	-	36	31.6	113%	1,832	35
Hardwood Tree Planting	Acres	1.73	1.73	-	-	79.5	2.5
Total Reductions						89,180	920
WIP Load Reduction Goal						325,215	8,578
Percent Load Reduction Achieved						53%	9%

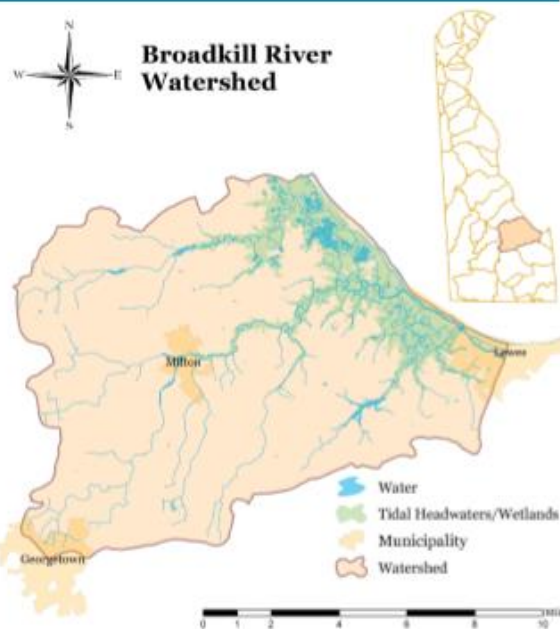
Broadkill River



Delaware Nonpoint Source Program 2018 Watershed Progress Report

Broadkill River

Watershed Description: The Broadkill River Watershed is located in the east central portion of Sussex County, Delaware. It is bounded on the north by the Cedar Creek Watershed, on the west by the Gravelly Branch and Deep Creek Watersheds, on the south by the Lewes-Rehoboth Canal, Rehoboth Bay, and Indian River Watersheds, and on the east by the Delaware Bay. The mainstem of the Broadkill River is approximately 25 miles long. The major watercourse in this segment is the Broadkill River, which originates at the Town of Milton, and discharges into the Roosevelt Inlet near Lewes. Major impoundments in the area are Waggamons and Diamond ponds located near Milton. The Broadkill River flows generally eastward until it approaches the coast where it turns abruptly and flows south to discharge into the Roosevelt Inlet. The flow of this stream is sluggish and the water is turbid. The watershed drains an area of 107 square miles.



Water Quality Trends



For more details see Appendix D at the end of the report.

BMP Progress FY 2018

BMP Name	Units	2018 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice & N Load Reductions (lbs/year)	Practice & P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	3,384	Annual	5,200	65%	42,945	199
Nutrient Relocation (net export from watershed)	Tons	908	Annual	1,900	48%	5,049	536
Nutrient Management	Acres	7,936	Annual	26,476	30%	22,163	11,083
Hardwood Tree Planting	Acres	.7	192.7	192	100%	6,633	506
Rain Garden	Structure	0	5.4	-	-	-	-
Total Reductions						76,790	12,324
WIP Load Reduction Goal						611,375	25,295
Percent Load Reduction Achieved						12.5%	49%



Chester and Choptank Rivers



Delaware Nonpoint Source Program 2018 Watershed Progress Report

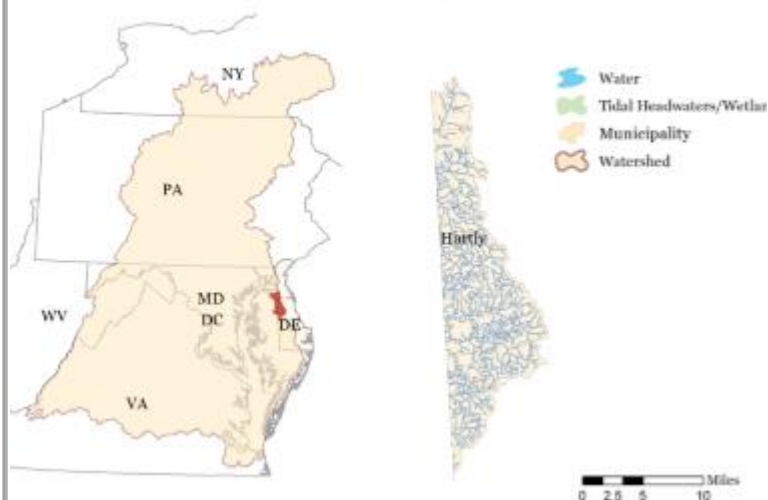
Chester and Choptank Watersheds

Watershed Description: The majority of the Chester and Choptank Watersheds are in Kent County, Delaware, while a portion of the Chester River originates in New Castle County, Delaware. Both rivers drain into Maryland's eastern shore, including Kent County, Queen Anne's County, and Caroline County. The Chester and Choptank Watersheds include 88,217.5 acres, or 137.8 square miles, of land area.

Chester River in Delaware includes a 40.0 square mile drainage area with headwaters beginning at the divide between New Castle and Kent Counties. Delaware headwater segments, including Cypress Branch, Sewell Branch, and Gravelly Run, flow west into both Kent County and Queen Anne's County, Maryland.

The Choptank River Watershed, located immediately south of the Chester River, includes 62,619.5 acres. Headwater tributaries to the Choptank River include Tappahanna Ditch, Culbreth Marsh Ditch, and Cow Marsh Creek.

Chester and Choptank Watersheds



Water Quality Trends



For more details see Appendix D at the end of the report.

BMP Progress FY 2018

BMP Name	Units	2018 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice & N Load Reductions (lbs/year)	Practice & P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	2,490	Annual	15,618	16	23,471	49
Nutrient Relocation (net export from watershed)	Tons	2,026	Annual	0	-	8,365	397
Nutrient Management	Acres	7,513	Annual	1,339	560	15,579	809
Hardwood Tree Planting	Acres	.4	197	172	114	6,152	153
Water Control Structures	Acres	-	348	3,120	11	2,602	0
Stream Restoration	Feet	-	1,924	11,880	16	260	303
Wetland Restoration	Acres	-	551	2,112	26	12,791	441
Total Reductions						69,220	2,152
WIP Load Reduction Goal						754,455	23,078
Percent Load Reduction Achieved						9%	9%



Christina Basin



Delaware Nonpoint Source Program 2018 Watershed Progress Report

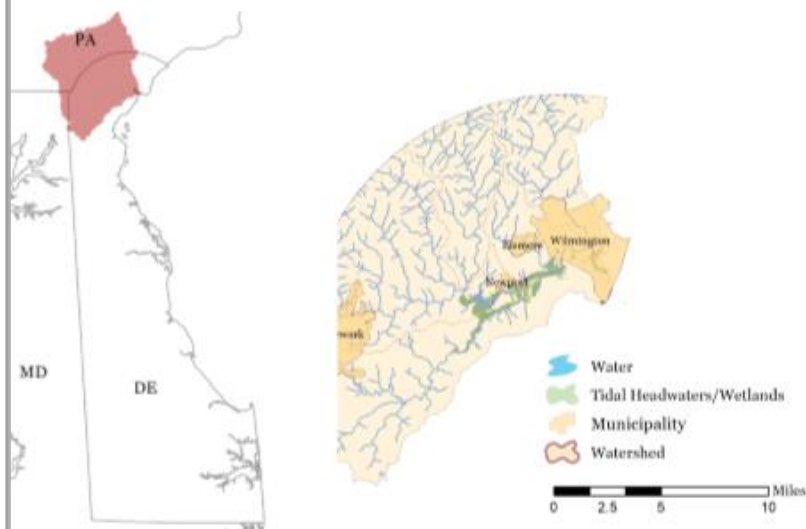
Christina Basin

Watershed Description: The Christina Basin is a 565 square mile basin contained in the larger Delaware River Basin. The Christina Basin, located in New Castle County in northern Delaware, includes four sub-watersheds:

- Brandywine Creek 325 sq. mi.
- Red Clay Creek 54 sq. mi.
- White Clay Creek 107 sq. mi.
- Christina River 78 sq. mi.

Although a small portion can be found within Maryland, the Christina Basin falls principally within two states, Pennsylvania to the north and Delaware to the south. The Pennsylvania portion is characterized by more open space, including agricultural land and forests, while the more urban, southerly portion in Delaware tends to have more built-up land. The Watershed Implementation Plan development for the Christina Watershed was approved by EPA in the Spring of 2013.

Christina Basin



Goals: Reduce pollutant loadings from current and future land use practices with an effort to achieve the TMDL through the efforts of numerous organizations and individuals. Delaware's efforts will be coordinated with the ongoing pollution reduction efforts in the Pennsylvania portion of the Christina Basin. The level of pollution reductions necessary to achieve the designated uses in the streams of the Delaware portion of the Christina Basin vary significantly. Nitrogen levels need to be reduced by 39,460 lbs/yr, and phosphorus levels by 1,716 lbs/yr. In contrast, other areas of the Christina Basin are relatively free of excess nitrogen, phosphorus, and bacteria and simply need to be protected in their current state.

Water Quality Trends



For more details see Appendix D at the end of the report.

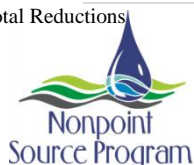
BMP Progress FY 2018

BMP Name	Units	2018 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice & N Load Reductions (lbs/year)	Practice & P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	-	Annual	12.4	-	-	-
Nutrient Management	Acres	1,526	Annual	7,559.0	20%	5,113	246
Rain Garden	Structure	-	36	31.6	113%	-	-
Stream Restoration	Feet	-	3,675	0.0	-	-	-
Hardwood Tree Planting	Acres	0.8	-	-	-	-	-
Total Reductions						5,113	246
WIP Load Reduction Goal						39,460	1,716
Percent Load Reduction Achieved						13%	14%

Total Reductions

5,113

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 Delaware Nonpoint Source Program 2018 Watershed Progress Report
Inland Bays

Inland Bays

Georgetown, Millboro, Dagsboro, Frankford, Selbyville, Lewes, Henlopen Acre, Rehoboth Beach, Dewey Beach, Ocean View, Millsville, Bethany Beach, South Bethany, Periwick Island

Water, Tidal Headwaters/Wetlands, Municipality, Watershed

0 1 2 3 4 5 6 7 8 9 10 Miles

Water Quality Trends

TP:  TN:  TSS: 

BMP Progress FY 2018							
BMP Name	Units	2018 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice & N Load Reductions (lbs/year)	Practice & P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	10,129	Annual	37,637	27%	137,344	499
Nutrient Relocation (net export from watershed)	Tons	12,328	Annual	20,909	59%	69,030	4,851
Nutrient Management	Acres	31,937	Annual	53,827	59%	89,817	6,899
Riparian Buffer (forest and vegetative)	Acres	1.5	241	3,235	7%	10,129	337
Wetland Restoration	Acres	-	29	4,175	1%	913	47
Rain Garden	Structure	-	1	3	33%	-	-
Total Reductions						307,233	12,633
WIP Load Reduction Goal						508,445	22,630
Percent Load Reduction Achieved						60%	56%

Nanticoke River

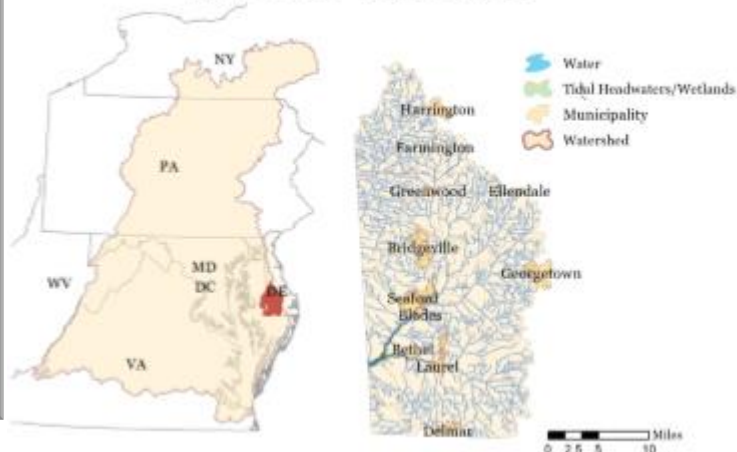


Delaware Nonpoint Source Program 2018 Watershed Progress Report

Nanticoke River Watershed

Watershed Description: The Nanticoke River Watershed includes the Middle Nanticoke and Upper Nanticoke Rivers. The majority of the two rivers originate in Sussex County, Delaware, while a portion of the Middle and Upper Nanticoke Rivers originate in Kent County, Delaware. Both rivers drain to the southwest into Maryland's eastern shore, including Caroline County, Dorchester County, and Wicomico County. The Nanticoke includes 315,890.7 acres, or 493.6 square miles, of land area. The Middle Nanticoke River refers to the Marshyhope Creek. Headwater tributaries to the Upper Nanticoke River include Gum Branch, Gravelly Branch, Deep Creek and Broad Creek.

Nanticoke Watershed



Goals: Current goals call for the increased implementation of numerous NPS BMPs, especially in the agriculture sector. The milestones allow jurisdictions the opportunity to adapt implementation strategies as necessary to meet the goals and achieve the TMDL standard. Delaware's milestone commitments are to annually reduce nitrogen by 3,391,050 pounds, phosphorus by 276,832 pounds, and sediment by 99,793,936 pounds by the end of 2025, compared to the 2009 baseline.

Water Quality Trends



For more details see Appendix D at the end of the report.

BMP Progress FY 2018

BMP Name	Units	2018 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice & N Load Reductions (lbs/year)	Practice & P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	24,870	Annual	10,448	238	313,274	872
Nutrient Relocation (net export from watershed)	Tons	22,275	Annual	Maximum available	-	134,489	8,765
Nutrient Management	Acres	26,438	Annual	1,258	-	75,655	5,201
Hardwood Tree Planting	Acres	0.5	690.5	157	439	31,726	990
Water Control Structures	Acres	-	1,219	2,394	51	9,106	0
Stream Restoration	Miles	-	1.3	465	.3	911	1,060
Wetland Restoration	Acres	-	1,929	74,043	3	65,480	3,098
Total Reductions						630,641	19,986
WIP Load Reduction Goal						3,391,050	276,832
Percent Load Reduction Achieved						19%	7%



Pocomoke and Wicomico Rivers



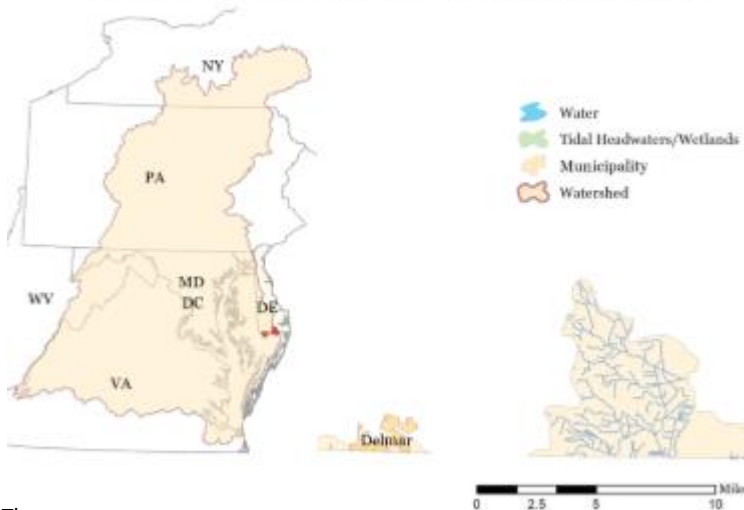
Delaware Nonpoint Source Program 2018 Watershed Progress Report

Pocomoke and Wicomico River Watershed

Watershed Description: The Pocomoke and Wicomico Rivers both originate in Sussex County, Delaware, and drain into Maryland's eastern shore, primarily in Wicomico County.

The Delaware portion of the Pocomoke River comprises 35 square miles and includes four headwater tributaries - Bald Cypress Branch, Gum Branch, Lewis Prong, and North Fork Green Branch. The headwaters for the Wicomico River begin at the Delaware-Maryland divide, with the Delaware portion contributing only 2.1 square miles. Four very small stream segments of the Wicomico watershed are located in Delaware, accounting for just 0.7 stream miles.

Pocomoke and Wicomico Watersheds



Goals: A TMDL was established in 2005 for the Pocomoke River. The Pocomoke nitrogen load allocations are 102.7lbs/day or 37,255.5 lbs/year. The Pocomoke phosphorus load allocations are 6.1 lbs/day or 2,228lbs/year. The Wicomico nitrogen and phosphorus load allocations are 9,103 lbs/year and 708 lbs/year, respectively.

Water Quality Trends



For more details see Appendix D at the end of the report.

BMP Progress FY 2018

BMP Name	Units	2018 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice & N Load Reductions (lbs/year)	Practice & P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	1,911	Annual	1,897	101	13,510	75
Nutrient Relocation (net export from watershed)	Tons	2,690	Annual	Maximum available	-	8,330	1,058
Nutrient Management	Acres	3,269	Annual	8,771	37	5,083	706
Hardwood Tree Planting	Acres	.06	49.3	24	205	1,047	71
Water Control Structures	Acres	-	87	189	46	650	0
Stream Restoration	Feet	-	481	1712	28	65	76
Wetland Restoration	Acres	-	138	154	90	2,403	222
Total Reductions						31,088	2,208
WIP Load Reduction Goal						46,359	714
Percent Load Reduction Achieved						67%	309%



St. Jones River

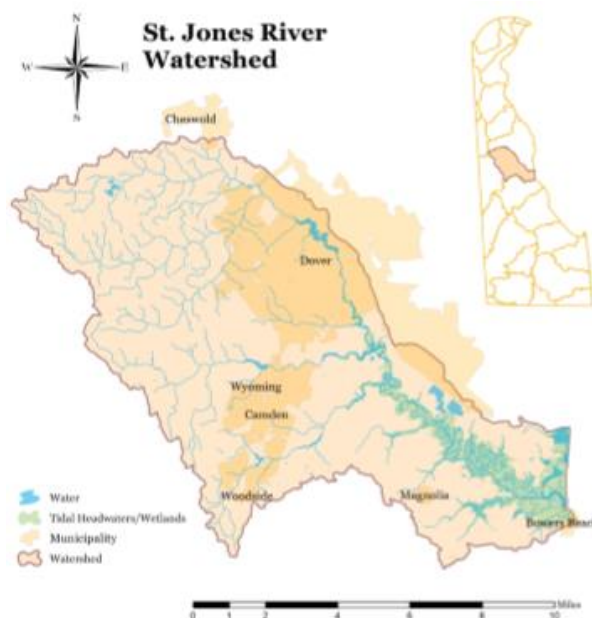


Delaware Nonpoint Source Program 2018 Watershed Progress Report

St. Jones River

Watershed Description: The St. Jones River Watershed is approximately 25.9 square miles (16,576 acres) and is located in the central portion of Kent County. It drains 90 square miles of land. The major watercourse in the watershed is the St. Jones River, which has its headwaters in the western part of the county, about 22 miles upstream from the Delaware Bay. Significant ponds in the watershed are Silver Lake, Moores Lake, and Wyoming Lake. Flat wetlands, usually forested, exist mostly in the upper portion of the watershed and eventually drain into creeks and streams. Non-tidal riverine wetlands and tidal wetlands line the banks of the river, sometimes up to a ½ mile wide toward the mouth of the river. Wetlands comprise 9,669 acres of the watershed and provide critical services, such as nutrient removal, erosion control, habitat for plants and wildlife, flood reduction, and storm water storage to the citizens of Delaware.

The St. Jones Watershed has 5,236 acres of protected lands , including 3,750 acres preserved in the St. Jones River Reserve.



Goals: Reduce the overall levels of nitrogen and phosphorus in the waterway by 40%, or 317,368 lbs/year and 23,141 lbs/year, respectfully. Nonpoint sources, must reduce total nitrogen from 306,053 lbs/ year and total phosphorus from 19,309 lbs/ year. The TMDL also calls for 7,957 lbs per year reduction of nitrogen and 1,241 lbs per year from its stormwater (MS4) discharges. The designated uses for the St. Jones River include primary recreation, secondary recreation, fish, aquatic life and wildlife, industrial water supply, and agricultural water supply in freshwater segments.

Water Quality Trends



For more details see Appendix D at the end of the report.

BMP Progress FY 2018

BMP Name	Units	2018 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice & N Load Reductions (lbs/year)	Practice & P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	1,325	Annual	6,247	21%	4,060	4
Nutrient Management	Acres	2,680	Annual	21,588	12%	1,807	48.50
Hardwood Tree Planting	Acres	1.7	1.7	-	-	16	0.2
Total Reductions						5,883	52.7
WIP Load Reduction Goal						317,368	23,141
Percent Load Reduction Achieved						2%	.1%



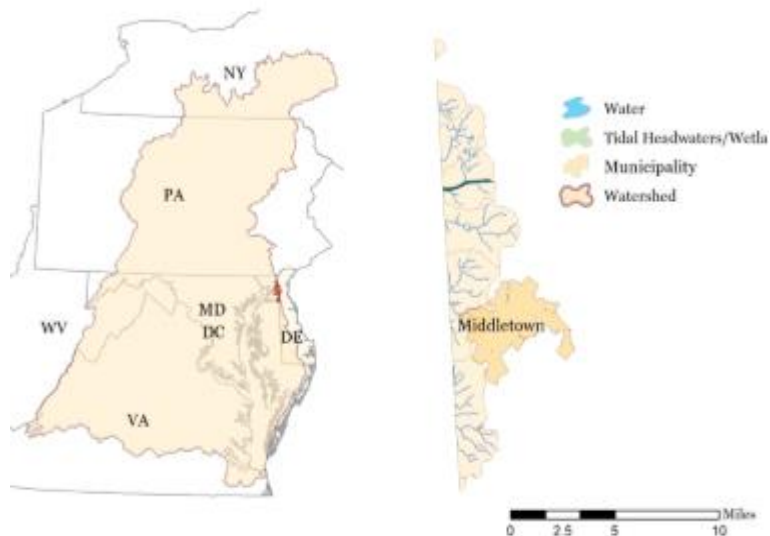
Upper Chesapeake Watershed

Watershed Description:

The Upper Chesapeake Watershed includes the Elk, Bohemia, and Sassafras Rivers and the C & D Canal , all of which originate in New Castle County, Delaware, and drain to the west into Maryland's upper eastern shore, primarily in Cecil County. The Upper Chesapeake includes 23,351.7 acres or 36.5 square miles of land area.

The Upper Chesapeake as a whole is made up of a mixture of land use, primarily including agriculture, forest, and developed lands . Over two-thirds of the Upper Chesapeake is agricultural use(38.4%) or developed land (34.0%) with the remaining land use largely comprised of forest (27.1%).

Upper Chesapeake Watershed



Goals: The watershed plan for the Upper Chesapeake says that load reductions proposed meet the allocations for the Upper Chesapeake in the Bay TMDL. By targeting the most effective BMPs to the critical areas with the greatest recovery potential, the TN agriculture load can be decreased from 112,510 to 60,365 lbs/year. The agricultural TP loads can be reduced from 119,235 to 6,134 lbs/year.

The TN urban load is second largest load and can be reduced from 67,790 to 60,138 lbs/year. Urban TP loads can be reduced from 4,332 to 3,668 lbs/year.

Water Quality Trends

TP:  TN:  TSS: 

For more details see Appendix D at the end of the report.

BMP Progress FY 2018							
BMP Name	Units	2018 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice & N Load Reductions (lbs/year)	Practice & P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	12,784	Annual	2,229	570	120,506	251
Nutrient Relocation (net export from watershed)	Tons	1,830	Annual	Maximum available	-	7,556	359
Nutrient Management	Acres	2,289	Annual	100%	-	4,748	246
Hardwood Tree Planting	Acres	0.3	49.55	-	-	1,544	38
Water Control Structures	Acres	-	87	155	56	650	0
Stream Restoration	Feet	-	481	2,732	176	65	76
Wetland Restoration	Acres	-	138	247	56	3,204	110
Total Reductions						138,273	1,080
WIP Load Reduction Goal						112,510	119,235
Percent Load Reduction Achieved						123%	1%

VII. Project Highlights

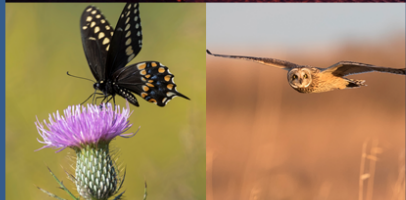
Photo Contest



Delaware Nonpoint Source Program 2018 Watershed Progress Report

2018 Photo Contest

1st place winners of each category received DE State Park passes and had their winning photographs featured in Outdoor Delaware magazine.



FIRST PLACE WINNERS

Top: 1st Place in Natural Landscapes and Waterscapes – Seaford, DE on the Nanticoke by Tammy Kearney

Bottom Left: 1st Place in Native Plants-Thistle Weed by Earl Blansfield

Bottom Right: 1st Place in Native Wildlife – Short-eared Owl in Flight by Earl Blansfield

What is the Delaware Watersheds Photo Contest?

2018 marked the first year of DNREC's Nonpoint Source (NPS) program's Delaware Watersheds Photo Contest, which replaced the rain barrel art contest from previous years. The goal of the contest was to share the beauty of Delaware's diverse environment and remind citizens that everything happening on land within the State's watersheds also directly affects what happens in our waterways.

The photo contest featured three categories:

1. Natural Landscapes and Waterscapes of Delaware
2. Native Wildlife of Delaware
3. Native Plants of Delaware

Who could enter? How did participants register?

Photographers of all ages were invited via social media and press releases to submit their photos of Delaware's waterscapes, landscapes, wildlife, and plant life to the Delaware Watersheds website. The contest was open to legal residents of the United States at the time of entry and encouraged photographers of all skill levels to enter. Photographs were required to be taken in Delaware, fit the properties criteria, fall within one of the three possible categories, and be submitted via email.

Over 300 submissions were received!

How were winners determined?

DNREC determined qualified entries that proceeded to the next stage of online public voting. The public determined the top 5 finalists in each category. The finalists were then on display at the 2018 Delaware State Fair and voted on by fairgoers to determine 1st 2nd and 3rd place winners.

DelawareWatersheds.org

Blackbird Tree Planting



Delaware Nonpoint Source Program 2018 Watershed Progress Report

2018 Blackbird Planting



More than 400 volunteers planted 8,800 hardwood seedlings at Blackbird State Forest to provide beauty, enhance wildlife habitat, fight invasive species, and improve the Chesapeake Bay. Student Caroline Dowd completed her Girl Scout Gold Award Project in cooperation with the Delaware Forest Service and DNREC's Division of Watershed Stewardship.



Arbor Day Foundation



Delaware Nonpoint Source Program 2018 Watershed Progress Report

2018 Arbor Day Foundation




IMPACT REPORT

THE COMMUNITY CANOPY AND ENERGY-SAVING TREES PROGRAM help improve communities through the use of trees. The trees being distributed to homeowners help clean the air and water. By planting the right trees in the right places to effectively shade their homes, people can also save money on their energy bills. Planting shade and windbreak trees for energy savings is already helping communities large and small improve energy efficiency, and the air, water and carbon benefits will continue to grow as the trees do. Through the program, we have partnered with 60 organizations within 36 states. Check out the overall impact these partner's programs are projected to have on the environment.



**projected 20 year cumulative values*

 **Arbor Day Foundation**

LP40177208

Established Fall 2018



NPS Grants



Nonpoint
Source Program

Delaware Nonpoint Source Program 2018 Watershed Progress Report

2018 Non-Point Source Grants

Non-Point Source Funding Grants

The U&CF Program also funded seven targeted projects for \$25,993. The goal was to enhance public open spaces and highlight the benefits of community trees. Funding was provided by the DNREC Watershed Stewardship Program's Non-Point Source Program.

NON-POINT SOURCE GRANTS		
Recipient	County	Amount
Academy Hill - Phase V	New Castle	\$5,000
City of Dover	Kent	\$1,350
Longacre Village	Kent	\$3,190
Delaware Botanic Gardens, Inc.	Sussex	\$5,000
The Village of Five Points	Sussex	\$3,000
James Farm Ecological Preserve	Sussex	\$4,978
The Grande at Canal Pointe	Sussex	\$3,475
TOTAL		\$25,993










VIII. Load Reductions

In 2018, the Delaware NPS Program load reductions were calculated for many of the 319 funded projects implemented on a watershed scale. The load reductions are calculated using guidance established during the Pollution Control Strategy development process.

2018 Project Load Reductions/Year by Watershed

Project	Nitrogen (lbs.)	Phosphorus (lbs.)
Upper Chesapeake Bay	138,273	1,080
Chester and Choptank	69,220	2,152
Nanticoke River	630,641	19,986
Pocomoke and Wicomico	31,088	2,208
St. Jones River	5,883	52.7
Inland Bays	307,233	12,633
Broadkill River	76,790	12,324
Appoquinimink River	89,180	920
Christina Basin	5,113	246
TOTAL	1,353,421	51,601.7

IX. Future Changes and Challenges

Delaware has developed this report to highlight accomplishments made in 2018 to reduce nitrogen, phosphorus, and sediment nonpoint source pollution. The charts and tables above signify the continued progress in reducing loads to impaired watersheds. Additional commitments were made, between DNREC and EPA, with the development of annual milestones identified in Delaware's 2015 NPS Management Plan. These milestones describe the outcomes and key actions expected each year. The NPS Management Plan includes objectives that address nonpoint sources of surface water and ground water pollution as appropriate (including sources of drinking water) in alignment with the goals of the Clean Water Act. Objectives of the plan include both implementation steps and how results will be tracked (e.g., water quality improvements or load reductions). Additionally, long-term goals and short-term milestones are integrated with other key environmental and natural resource programs. NPS's

program goals and objectives are periodically revised to reflect progress or problems encountered, develop strategies to make progress towards achieving the goals, and develop indicators to measure progress. Updates to the NPS Milestones can be found in Appendix A.

Delaware continues to make progress to meet water quality goals with continued commitments of funding implementation activities to address the agriculture and urban sectors. For example, many of the key personnel working within the County Conservation Districts help to write nutrient management plans, install agriculture best management practices, and help farmers to identify resource concerns. Additional DNREC staff work with private landowners on buffers, wetland and stream restoration projects, and septic system pump-outs, repairs, and/or replacements.

While some goals have been missed, Delaware has continued to make substantial progress and has invested significant effort into programmatic changes, such as regulations, permits, and reorganizing programs. Although these additional efforts improve accountability, they do not have immediate input into nutrient reductions. Delaware's agricultural community works every day to conserve and protect our water resources, with many of our farmers implementing BMPs that are not accounted for or reported. We are now capturing some of the previously unreported BMP data through statewide driving surveys and Chesapeake Bay related verification efforts. Funding for cover crop cost-share programs has increased farmer participation and allowed us to increase cover crop BMP implementation acreages. In terms of regulations, in 2013, Delaware promulgated new On-Site Wastewater Regulations. The implementation of this new regulation is helping Delaware to meet future nutrient reduction goals for septic connections, pump-outs, and advanced treatment systems.

Delaware's NPS Program, since experiencing reorganization, has aligned the following programs - 319 NPS program, Chesapeake Bay Implementation Program, Conservation Reserve Enhancement Program and additional funding and resources through Delaware's Water Infrastructure Advisory Committee. The newly enhanced NPS Program has proven its efficiency by centralizing and reducing data reporting requirements while increasing grant funding availability and leveraging capacity for federal grants while expanding partnerships.

Looking forward, Delaware's NPS Program will continue to make progress toward our goals and will work to align funding with water quality priorities. Although our state faces many challenges, we remain committed to working with our partners at the state, local, and federal levels to reduce the levels of nonpoint source pollution from entering our waterbodies.

X. List of Partner Organizations/Committee Members

The hard work and many hours of agency staff members, organization members and private individuals who have partnered with the NPS Program in 2018 to address, reduce, identify and/or measure NPS pollution in Delaware is greatly appreciated. This NPS pollution control and prevention program has been very active, well received and effective. It is a credit to our partners as they have cooperated in the face of many conflicts to make this program what it is today.

Name	Agency	Name	Agency
Absher, Debbie	Sussex Conservation District	Nelson, Jennifer	Delaware Assoc of Conservation Districts
Arthurs, Jayme	NRCS State Office	Palmer, Robert	Conservation Programs
Bason, Chris	Center for the Inland Bays	Riley, Tim	Kent Conservation District
Biddle, Mark	Watershed Stewardship	Rutherford, Jamie	Sediment & Stormwater
Bounds, Kenny	DE Department of Agriculture	Saveikis, David	Fish&Wildlife
Brosch, Chris	Delaware Nutrient Management Program	Schepens, Dave	Groundwater Discharges
Brown, Lori	NPS Program	Sevcik, Clare	NPS Program
Cassidy, Jim	Groundwater Discharges	Sturgis, Brittany	NPS Program
Chaconas, Jim	Wetlands & Subaqueous Lands	Suffian, Fred	US EPA
Cole, Kimberly	Delaware Coastal Program	Sullivan, James	NPS Program
Coleman, Bob	Delaware Nutrient Management Program	Taylor, Kacey	USDA/NRCS
Donnelly, Kevin	New Castle Conservation District	Vacant	Delaware CREP Program
Esposito, Sara	DE Department of Transportation	Volk, Jenn	University of Delaware
Foskey, Kip	Sussex Conservation District	Walch, Marianne	Center for the Inland Bays
Fox, Marcia	NPS Program	Watson, Jessica	Sussex Conservation District
Garrahan, Tim	NRCS State Office	Webb, Sharon	NPS Program
Hogan, Mark	NPS Program	Williams, Chuck	Shoreline
Kauffman, Jerry	UD Water Resources Agency	Williams, Steve	Watershed Stewardship
Kepfer, Sally	NRCS State Office	Wilson, Bart	U.S. Fish and Wildlife Service
Lewandowski, Ed	University of Delaware	Wozniak, Sara	Watershed Stewardship
Manges, Lynn	Farm Service Agency	Zeiters, Brenda	NPS Program
Monteith, Tyler	NPS Program		

Appendices

Appendix A – 2018 Milestones

Delaware NPS Program Short, Mid and Long Term Milestones		
Short and Mid Term Milestones (2015 – 2019)	Deliverable	Comments/Status Updates
Establish baseline conditions for program indicators	Program indicator baseline	Efforts are currently underway to develop a compendium of Environmental Indicator (EI) data sets to communicate with the public. NPS staff has attended several EI meetings to discuss datasets that could be focused on for measuring the State's environmental conditions and status, and DNREC's performance. DNREC's Environmental Indicator initiative is now called The Environmental Perspectives Project. This new initiative will highlight agency's role in restoring, protecting, and enhancing the environment through data-driven storytelling. The purpose of the Project is to disseminate information to the public in a manner that is understandable and provides context for the purpose of the work DNREC does. "Reducing Nonpoint Source Pollution" will be a topic, in the future, for this Project. 2018 Update: In 2019, DNREC will launch a public facing website to keep the public informed on EI data sets identified as nonpoint source issues and best management practice implementation.
Update Delaware's NPS Management Plan	Management Plan	Work with the NPS Advisory Committee to revise and update the 2014 NPS Management Plan. Plan will be reviewed in 2018 when Milestones are updated. 2018 Update: A complete plan will be provided to EPA in 2019.
Complete approval of all existing watershed plans	Watershed plans	COMPLETED
Complete baseline sampling for initial priority watersheds	Priority watershed baseline	Establish baseline load reductions based on current monitoring data achieved in select Delaware watersheds to be determined as funding allows. 2018 Update: As part of the Management Plan process, using historical figures, and EPA modeling tools, DE's NPS Program determined 2002 as the baseline year for the 2019 Management Plan.

Estimated pollutant load reductions achieved for sediment, phosphorus and nitrogen from BMPs implementation in priority watersheds.	Increase annual load reductions as funding allows	Increase annual load reductions in non-Chesapeake Bay priority watersheds by 2% annually from the FY2015 baseline. Increase annual load reductions in Chesapeake Bay priority watersheds by 20% annually from the FY2015 baseline (to be determined as funding allows) for FY2015. 2018 Update: Comparing 2017 to 2018 nitrogen reductions increased in the following watersheds - Inland Bays, Appoquinimink, and Christina Basin; all other watershed nitrogen reductions decreased. Comparing 2017 to 2018 phosphorus reductions increased in the following watersheds – Inland Bays, Broadkill River, Christina Basin; all other watershed phosphorus reductions decreased.
Reduce nutrient loads from NPS sources in Delaware's priority watersheds.	Establish baseline load reductions from BMP implementation	Establish baseline of load reductions from BMP implementation in FY 2015 for the following priority watersheds: Inland Bays, Little Assawoman Bay, St. Jones River, Appoquinimink River, and Christina River. 2018 Update: Through the development of the 2019 Management Plan development, the modeling tools used for the Chesapeake Bay will be used for all watersheds to assess progress from the determined 2002-baseline year. Using the Chesapeake Assessment Scenario Tool, loads will be assessed to enumerate progress in the Management Plan.
Increase number of outreach and education interactions	Increase number of outreach and education interactions by 10% over FY 2015 baseline	COMPLETED. This goal has been met through an outreach initiative relying on a variety of channels to deliver water quality messaging. These messaging outlets include the following but are not limited to printed/radio/TV advertising, events, workshops, presentations, programs, competitions, videos, webinar hosting's, websites, social media, email/newsletters, recreational opportunities and promotional materials. 2018 Update: This goal was met in 2017; baseline was one large outreach event annually at the DE State Fair. DE's NPS Program continues to provide outreach and education interactions to citizens across the State. More specifically, in 2018, the Program: held outreach events at the Delaware State Fair (3,037 interactions), Non-Point Source's photo contest (4,311 votes for photos), Becoming an Outdoors Woman Rain Barrel Building Workshop (9 participants); Rain garden maintenance assistance with Youth Conservation Corp (12 individuals over 2 days), Coast Day (>500 interactions), Blackbird Creek Fall Festival (600 interactions), Community Canopy tree giveaway (engaged 3,529 through social media campaigns).

Remove NPS related impairments from stream segments	one stream segment (2015) five stream segments (2019)	One stream segment will be identified annually as having improved water quality baseline assessment and will be included in the NPS annual success story. In 2015, one stream segment was removed. A total of five stream segments will be identified as having improved water quality baseline assessment by 2019. Update 2018: Coursey Pond (2015), Abbotts Mill Pond (2016), Records Pond (2017), Trap Pond (2018); additionally a GIS Success Story interactive map was created to highlight Success Stories of the Program - https://bit.ly/2UCZSep
Assess interim and 2015 progress milestones	Biennial milestone updates	Assessment ongoing. 2018 Update: Assessment will be complete in 2019 as part of Management Plan update.
Show relative progress towards BMP implementation activities for all the EPA approved watershed plans	Increase BMP implementation annually by watershed	Progress ongoing. 2018 Update: Assessment will be complete in 2019 as part of Management Plan update.
Demonstrate water quality improvement in the priority watersheds resulting from plan implementation activities	303(d) de-listing	305(b) reports are prepared every even numbered year. Any water quality improvements would result in a 303(d) delisting. The 2016 combined watershed report for 305(b) and 303(d) was approved in August 2017. 2018 Update: DNREC maintains delisting records and are included in this report.
Show a 10% decrease of pollutant loadings in 50% or more of the priority watersheds	Annual load reduction decreases	Increase load reductions annually in non-Chesapeake Bay priority watersheds by 2% and by 20% in Chesapeake Bay priority watersheds from baseline. 2018 Update: Comparing total reductions to WIP reduction loads, nitrogen loads were achieved for Inland Bays (60%), Broadkill River (12.5%), Appoquinimink River (53%), Chesapeake Bay (54%), and Christina Basin (13%). Comparing total reductions to WIP reduction loads, phosphorus loads were achieved for Inland Bays (56%), Broadkill River (49%), Appoquinimink River (9%), Chesapeake Bay (81%), and Christina Basin (14%).

Show annual increases in funding and quantities of BMPs implemented in priority watersheds	Procurement of funds to close BMP implantation gaps	NPS will seek alternative funding sources to assist with implementation of water quality BMPs. 2018 Update: the NPS Program has leveraged funding on a project through the NRCS Regional Conservation Partnership Program (RCPP) for buffers around stormwater management ponds in poultry headquarters. Additionally, NPS worked with the Maryland Environmental Finance Center and the Nanticoke Watershed Alliance on a project funded by the National Fish and Wildlife Foundation. The goal of the project is to develop a stormwater management strategy that targets programming for a variety of regulated and unregulated landowners in the region to meet Chesapeake Bay Phase III WIP 2025 goals. In 2019, NPS will collaborate with agricultural partners to submit another RCPP grant application through NRCS.
Remove one stream segment per year from the 303(d) list through 2019	Removal of 303(d) stream segment	305(b) reports are prepared every even numbered year. Any water quality improvements would result in a 303(d) delisting. NPS will maintain delisting records and update annually. Significant delistings, as a result of NPS Program activities, will be highlighted in the annual NPS success story. 2018 Update: Trap Pond was highlighted as the 2018 success for removal of a stream segment from the 303(d) report.
Long Term Milestones (2019-2030)	Deliverable	Comments/Status Updates
Complete BMP implementation for 75% of the EPA approved watershed plans	Increase BMP implementation by 75%	Progress ongoing. 2018 Update: This goal will be reassessed in the 2019 NPS Management Plan.
Remove 50% or more of high priority TMDLs from 2010 303(d) list	Removal of half of high priority TMDLs from 303(d) list	Ongoing. 2018 Update: High priority TMDLs are monitored closely by the State and are reviewed in 303(d) lists created by the Watershed Assessment and Management Section (WAMS) of DNREC. DE NPS Program's GIS coordinator worked closely with WAMS and EPA in 2018 to update the Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System (ATTAINS). ATTAINS is an online system for accessing information about the conditions in the Nation's surface waters. ATTAINS contains information on waters that are not supporting their designated uses. These waters are listed by the state as impaired Under CWA section 303(d). The database also tracks the status of TMDLs and actual TMDL reports.

Appendix B – 2018 Annual BMP Nutrient reductions for N & P

Nitrogen Load Reductions (lbs./year)	Upper Chesapeake	Chester /Choptank	Nanticoke	Pocomoke/ Wicomico	St. Jones River	Inland Bays	Broadkill River	Appoquinimink River	Christina Basin	Total P (lbs./year)
Cover Crops	120,506	23,471	313,274	13,510	4,060	137,344	42,945	71,789	0	726,899
Nutrient Relocation	7,556	8,365	134,489	8,330	0	69,030	5,049	0	0	232,819
Nutrient Management	4,748	15,579	75,655	5,083	1,807	89,817	22,163	15,479	5,113	235,444
Hardwood Tree Planting	1,544	6,152	31,726	1,047	16	10,129	6,633	79.5	0	57,326.5
Water Control Structures	650	2,602	9,106	650	0	0	0	0	0	13,008
Stream Restoration	65	260	911	65	0	0	0	0	0	1,301
Wetland Restoration	3,204	12,791	65,480	2,403	0	913	0	0	0	84,791
Total N Reductions	138,273	69,220	630,641	31,088	5,883	307,233	76,790	87,347.5	5,113	1,351,588.5

Phosphorus Load Reductions (lbs./year)	Upper Chesapeake	Chester /Choptank	Nanticoke	Pocomoke/ Wicomico	St. Jones River	Inland Bays	Broadkill River	Appoquinimink River	Christina Basin	Total P (lbs./year)
Cover Crops	251	49	872	75	4	499	199	138	0	2,087
Nutrient Relocation	359	397	8,765	1,058	0	4,851	536	0	0	15,966
Nutrient Management	246	809	5,201	706	48.5	6,899	11,083	744	246	25,982.5
Hardwood Tree Planting	38	153	990	71	0.2	337	506	2.5	0	2,097.7
Water Control Structures	0	0	0	0	0	0	0	0	0	0
Stream Restoration	76	303	1,060	76	0	0	0	0	0	1,515
Wetland Restoration	110	441	3,098	222	0	47	0	0	0	3,918
Total P Reductions	1080	2152	19,986	2,208	52.7	12,633	12,324	884.5	246	51,566.2

Appendix C – Water Quality Trend Data

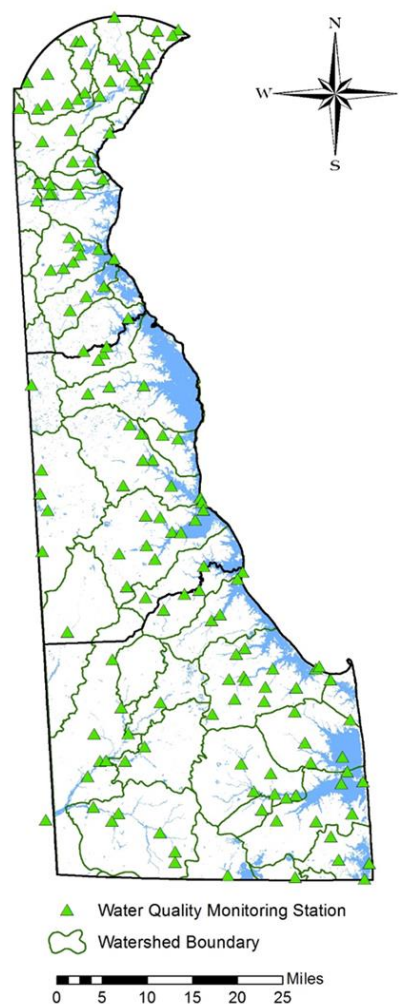
Total nitrogen and total phosphorus data from 1999-2018 for all Delaware STORET stations was retrieved. Data from stations with 40 or more data points were analyzed using WQSTAT software to evaluate for concentration trends using non-parametric methods (133 stations had 40 or more data points for total phosphorus and 132 stations for total nitrogen). The software reported statistically significant trends at various confidence levels, depending on the type of statistical test used. For regulatory purposes, the Department would not ordinarily consider 80 or 90 percent confidence levels as a trigger for further action. For this analysis, however, the lower confidence results are reported and mapped to aid in “telling the story,” especially in the mapped data. See map (right) and tables below (pages 33-42).

Of the 133 stations evaluated for total phosphorus concentration trends, 45 had statistically significant trends. Upward and downward trends were closely divided. Eighty-eight stations showed no trend, either positive or negative. Of the 132 stations evaluated for total nitrogen concentration trends, 76 stations had statistically significant trends and 56 stations had no trend upward or downwards. The vast majority of significant trends for total nitrogen were downward trends, mostly at higher confidence levels.

One hundred forty stations were analyzed for trends in measured concentrations of total suspended solids for the 1998-2014 period of record. Of those 140 stations, 61 stations had statistically significant trends. Of the 61 stations with trends, six stations had statistically significant upward trends and the remaining 55 stations showed downward trends. Seventy-nine stations did not have statistically significant trends either upward or downward.

Chesapeake Bay Non-tidal Monitoring

For 2018, Delaware DNREC is participating in a multi-State non-tidal monitoring Program conducted by the Chesapeake Bay Program and other jurisdictions, including Maryland, Virginia, West Virginia, Pennsylvania, New York, and the District of Columbia. The Non-Tidal Monitoring Network contains about 120 monitoring sites with the following two sites in Delaware: (1) Nanticoke River near Bridgeville and (2) Marshyhope Creek at Fishers Bridge Road. Monitoring at the sites is conducted monthly using sample collection protocol developed by the Chesapeake Bay Program non-tidal monitoring workgroup (1). In addition to monthly sampling, eight storm samples per year (two per season) are collected at these sites.



Continuous Water Quality Monitoring

Delaware DNREC, in cooperation with the Delaware Geological Survey (DGS) and the United States Geological Survey (USGS), is maintaining a number of continuous monitoring sites in the State. During FY 2018, six sites in Delaware are being monitored continuously. These sites include Brandywine Creek at Wilmington, Christina River at Newport, Appoquinimink River near Odessa, Millsboro Pond Outlet at Millsboro, Broadkill River near Milton, and Massey Ditch at Massey Landing.

Measurements of water temperature, dissolved oxygen (DO), pH, and specific conductance at these sites are conducted at every 15 minute interval by using multi-parameter water-quality data sondes (such as YSI sondes). All data are collected following USGS protocols and will be stored in USGS National Water Information System (NWIS) databases, <http://waterdata.usgs.gov/de/nwis/current/?type=quality>.

Station	Watershed	Station Location	Total N count	Total N Trend	Total N Confidence	Total P Count	Total P trend	Total P Confidence	TSS Count	TSS Trend	TSS Confidence
101021	Naamans Creek	Naaman Creek @ State Line near Hickman Rd.	115	--	--	111	--	--	115	0.1322	98
101031	Naamans Creek	Naaman Creek S. Branch @ Darley Rd. (Rd. 207)	90	-0.052	98	90	--	--	90	-0.0851	95
101061	Naamans Creek	Naaman Creek South Branch @ Marsh Rd. (Rt. 3)	66	--	--	64	--	--	66	0	--
102041	Shellpot Creek	Shellpot Creek @ Hay Rd. (Rd. 501)	106	-0.052	98	104	--	--	106	-0.8908	95
102051	Shellpot Creek	Shellpot Creek @ Market St. (Rt. 13 Bus.)	95	--	--	93	--	--	95	0	--
102081	Shellpot Creek	Shellpot Creek @ Carr Rd.	64	-0.041	98	62	--	--	64	0	--
103011	Red Clay Creek	Stanton, Rt. 4 at Stanton Bridge (USGS gage 01480015)	115	--	--	114	-0.006	95	115	-0.1105	--
103031	Red Clay Creek	Red Clay Creek @ Lancaster Pike (Rt. 48)	142	--	--	141	-0.005	95	142	-0.0978	90
103041	Red Clay Creek	Red Clay Creek @ Barley Mill Rd. (Rd. 258A)	115	--	--	114	-0.010	95	115	-0.2505	98
103061	Red Clay Creek	Burroughs Run @ Creek Rd. (Rt. 82)	115	-0.017	90	114	--	--	116	-0.1187	98
104011	Brandywine Creek	Brandywine Creek @ Foot Bridge in Brandywine Park	114	--	--	113	-0.002	90	114	-0.0694	--
104021	Brandywine Creek	Brandywine Creek @ New Bridge Rd. (Rd. 279)	143	-0.019	95	142	--	--	143	0	--
104051	Brandywine Creek	Brandywine Creek @ Smith Bridge Rd. (Rd. 221)	113	--	--	111	--	--	113	-0.2003	95
105031	White Clay Creek	White Clay Creek @ Chambers Rock Rd. (Rd.	114	--	--	113	-0.005	95	115	-0.3199	98

Station	Watershed	Station Location	Total N count	Total N Trend	Total N Confidence	Total P Count	Total P trend	Total P Confidence	TSS Count	TSS Trend	TSS Confidence
		329)									
105151	White Clay Creek	White Clay Creek @ Delaware Park Blvd.	144	--	--	142	-0.002	90	144	-0.0949	--
105171	White Clay Creek	White Clay Creek @ McKees Lane	96	--	--	94	--	--	96	-0.2606	--
106021	Christina River	Christina River beneath Rt. 141 Bridge	105	-0.046	95	105	--	--	105	-0.5993	95
106031	Christina River	Smalleys Dam Spillway @ Smalleys Dam Rd.	108	--	--	106	--	--	108	-0.1913	--
106141	Christina River	Christina River @ Sunset Lake Rd. (Rt. 72)	135	-0.046	98	132	--	--	135	-0.3515	98
106191	Christina River	Christina River @ Nottingham Rd. (Rt. 273)	108	--	--	103	--	--	108	0	--
106281	Christina River	Little Mill Creek @ DuPont Rd.	108	-0.049	95	104	--	--	108	-0.2813	98
106291	Christina River	Christina River near Conrail Bridge	124	-0.030	95	124	-0.001	90	124	-0.3691	--
107011	Red Lion Creek	Red Lion Creek @ Bear Corbitt Rd. (Rt. 7)	105	-0.027	98	104	--	--	105	-0.1792	98
107031	Red Lion Creek	Red Lion Creek @ Rt. 9	103	--	--	102	0.004	95	103	-0.5605	--
108021	Chesapeake & Delaware Canal	C & D Canal @ DuPont Pkwy. (Rt. 13) N. side	102	--	--	101	--	--	102	0.5151	--
108111	Chesapeake & Delaware Canal	Lums Pond @ Boat Ramp	97	-0.023	95	108	--	--	--	--	--
109041	Appoquinimink River	Appoquinimink River @ DuPont Pkwy. (Rt. 13)	101	-0.051	95	103	--	--	104	-0.1259	--
109071	Appoquinimink River	Drawyer Creek off Rt. 13 @ parking area	103	-0.047	95	103	--	--	104	-0.8321	--

Station	Watershed	Station Location	Total N count	Total N Trend	Total N Confidence	Total P Count	Total P trend	Total P Confidence	TSS Count	TSS Trend	TSS Confidence
109091	Appoquinimink River	Appoquinimink River @ Mouth	104	-0.022	95	103	--	--	104	0.111	--
109121	Appoquinimink River	Appoquinimink River @ Silver Run Rd. (Rt. 9) NE	103	-0.026	95	102	-0.002	80	103	-1.217	95
109131	Appoquinimink River	Noxontown Pond @ Noxontown Rd. (Rd. 38)	96	-0.020	90	102	-0.001	90	104	-0.1677	--
109171	Appoquinimink River	Appoquinimink River @ MOT Gut (west bank)	94	-0.022	95	95	--	--	96	-0.1207	--
109191	Appoquinimink River	Shallcross Lake @ Shallcross Lake Rd. (Rd. 428)	103	-0.073	95	101	--	--	103	0	--
109251	Appoquinimink River	Deep Creek Branch @ Summit Bridge Rd. (Rt. 71)	86	-0.222	98	84	--	--	85	0	--
110011	Appoquinimink River	Blackbird Creek @ Blackbird Station Rd. (Rd. 463)	95	-0.028	90	97	--	--	98	0	--
110031	Lower Blackbird	Blackbird Creek @ Blackbird Landing Rd. (Rd. 455)	60	--	--	66	0.005	90	66	-0.4215	--
110041	Lower Blackbird	Blackbird Creek @ Taylors Bridge Rd. (Rt. 9)	101	-0.040	95	99	--	--	101	-0.8024	--
111011	Dragon Run Creek	Dragon Creek @ Wrangle Hill Rd. (Rt. 9)	91	--	--	104	0.003	95	--	--	--
111031	Dragon Run Creek	Dragon Creek @ S. DuPont Hwy. (Rt. 13)	99	-0.041	95	98	--	--	--	--	--
112021	Chesapeake Drainage System	Sewell Branch @ Sewell Branch Rd. (Rd. 95)	97	-0.062	95	102	--	--	101	0	--
114011	Army Creek	Army Creek @ River Rd. (Rt. 9)	97	-0.059	98	98	0.003	90	99	1.282	98

Station	Watershed	Station Location	Total N count	Total N Trend	Total N Confidence	Total P Count	Total P trend	Total P Confidence	TSS Count	TSS Trend	TSS Confidence
201011	Smyrna River	Mill Creek (Lake Como outfall) @ Rt. 13	57	--	--	68	--	--	68	-0.6384	95
201021	Smyrna River	Mill Creek @ Carter Rd. (Rd. 137)	96	-0.048	95	101	--	--	103	0	--
201041	Smyrna River	Smyrna River @ Flemings Landing (Rt. 9)	104	-0.028	95	102	--	--	104	-2.199	90
201051	Smyrna River	Duck Creek @ Smyrna Landing Rd. (Rd. 485)	96	--	--	102	--	--	104	0.348	--
201161	Smyrna River	Providence Creek @ Duck Creek Rd. (Rt. 15)	99	--	--	94	--	--	99	-0.2022	95
202021	Leipsic River	Garrisons Lake @ DuPont Hwy. (Rt. 13)	87	-0.027	80	102	--	--	--	--	--
202031	Leipsic River	Leipsic River @ Denny St. (Rt. 9)	102	-0.033	95	102	--	--	--	--	--
202191	Leipsic River	Leipsic River @ Mt. Friendship Rd. (Rt. 15)	60	-0.095	98	62	-0.004	90	62	-0.2735	--
204031	Little River	Little River @ Bayside Dr. (Rt. 9)	104	-0.043	98	103	--	--	104	0.7003	--
204041	Little River	Little River @ N. Little Creek Rd. (Rt. 8)	105	--	--	104	--	--	105	-0.2628	--
205011	Saint Jones River	St. Jones River @ mouth, Bowers Beach	79	-0.076	98	80	--	--	82	-0.5981	--
205041	Saint Jones River	St. Jones River @ Barkers Landing	105	-0.025	95	104	--	--	101	-2.113	95
205091	Saint Jones River	St. Jones River @ East Lebanon Rd. (Rt. 10)	100	-0.067	95	101	--	--	101	-1.491	98
205151	Saint Jones River	Fork Branch @ State College Rd. (Rd. 69)	92	-0.021	90	99	-0.003	80	99	-0.2912	98
205181	Saint Jones River	Moore's Lake @ S. State St. (Rd. 27)	100	--	--	101	0.001	95	101	-0.126	--

Station	Watershed	Station Location	Total N count	Total N Trend	Total N Confidence	Total P Count	Total P trend	Total P Confidence	TSS Count	TSS Trend	TSS Confidence
205191	Saint Jones River	Silver Lake @ Spillway (Dover City Park)	104	--	--	128	0.001	80	129	-0.1408	--
205211	Saint Jones River	Derby Pond @ Boat Ramp (Rt. 13A)	94	--	--	99	0.001	95	99	0	--
206011	Murderkill River	Murderkill River @ Rt. 13	168	--	--	165	--	--	168	-0.1614	95
206041	Murderkill River	Browns Branch @ Milford-Harrington Hwy. (Rt. 14)	138	-0.219	98	136	--	--	138	-0.2408	98
206091	Murderkill River	Murderkill River @ Bay Rd. (Rt. 1/113)	134	-0.028	80	132	-0.005	95	134	-1.705	95
206101	Murderkill River	Murderkill River @ Bowers Beach Wharf (mouth)	148	-0.020	80	153	--	--	153	-2.484	95
206141	Murderkill River	Murderkill River near levee @ MNWA (RM 3.25)	124	--	--	123	-0.007	98	124	-1.906	95
206231	Murderkill River	Murderkill Rv. @ confl. of KCWWTF discharge ditch	123	-0.038	90	121	-0.006	80	123	-1.594	95
206361	Murderkill River	McColley Pond @ Canterbury Rd. (Rt. 15)	138	--	--	136	0.001	95	138	0	--
206451	Murderkill River	Coursey Pond @ Canterbury Rd. (Rt. 15)	129	0.031	80	134	--	--	136	-0.4087	95
206561	Murderkill River	Double Run @ Barratts Chapel Rd. (Rd. 371)	135	-0.080	95	134	0.002	90	135	0.4632	80
207021	Choptank	Cow Marsh Creek @ Mahan Corner Rd. (Rd. 208)	99	--	--	99	0.001	90	99	0	--
207081	Choptank	Tappahanna Ditch @ Sandy Bend Rd. (Rd. 222)	98	-0.020	80	101	0.002	80	101	0	--
207091	Choptank	Culbreth Marsh Ditch @ Shady Bridge Rd. (Rd. 210)	102	0.031	95	102	--	--	102	-0.0905	--

Station	Watershed	Station Location	Total N count	Total N Trend	Total N Confidence	Total P Count	Total P trend	Total P Confidence	TSS Count	TSS Trend	TSS Confidence
207111	Choptank	White Marsh Br. @ Cedar Grove Church Rd. (Rd. 268)	100	0.100	98	100	--	--	100	-0.0412	80
208021	Mispillion River	Mispillion River @ Rt. 1	107	--	--	106	-0.171	80	107	-1.134	95
208061	Mispillion River	Mispillion River @ Cedar Creek confluence	103	-0.036	95	110	--	--	110	-1.485	80
208181	Mispillion River	Abbotts Pond @ Abbotts Pond Rd. (Rd. 620)	109	--	--	104	--	--	108	0	--
208211	Mispillion River	Silver Lake @ Maple Ave.	108	--	--	107	--	--	109	-0.3279	95
208231	Mispillion River	Beaverdam Branch @ Deep Grass Ln. (Rd. 384)	110	0.053	98	106	--	--	109	-0.237	95
301021	Cedar Creek	Swiggetts Pond @ Cedar Creek Rd. (Rt. 30)	108	0.031	80	104	--	--	107	-0.1727	95
301031	Cedar Creek	Cedar Creek @ Coastal Hwy. (Rt. 1)	110	--	--	109	0.004	95	109	0.3437	--
301091	Cedar Creek	Cedar Creek @ Cedar Beach Rd. (Rt. 36)	108	-0.031	95	106	--	--	109	-0.8542	--
302031	Marshyhope Creek	Marshyhope Creek @ Fishers Bridge Rd. (Rd. 308)	185	--	--	185	--	--	186	0	--
303011	Broadkill River	Savannah Ditch @ Savannah Drive (Rd. 246)	103	-0.416	90	102	--	--	102	0	--
303021	Broadkill River	Ingram Branch @ Gravel Hill Rd. (Rd. 248)	104	0.154	80	103	0.015	95	--	--	--
303031	Broadkill River	Broadkill River @ Union St (Rt. 5)	136	-0.063	95	133	--	--	135	0	--
303041	Broadkill River	Broadkill River @ Rt. 1 Bridge	104	-0.058	95	103	0.002	80	103	-0.792	--

Station	Watershed	Station Location	Total N count	Total N Trend	Total N Confidence	Total P Count	Total P trend	Total P Confidence	TSS Count	TSS Trend	TSS Confidence
303051	Broadkill River	Red Mill Pond @ Rt. 1	96	--	--	103	-0.003	95	103	-0.7305	95
303061	Broadkill River	Broadkill River 0.10 Miles From Mouth	81	--	--	85	--	--	87	0	--
303171	Broadkill River	Beaverdam Creek @ Cave Neck Rd. (Rd. 88)	105	--	--	103	-0.003	95	104	0	--
303181	Broadkill River	Beaverdam Creek @ Carpenter Rd. (Rd. 259)	103	-0.266	98	100	-0.010	95	102	-0.3657	98
303311	Broadkill River	Round Pole Branch @ Cave Neck Rd. (Rd. 88)	103	0.044	80	101	--	--	102	0	--
303331	Broadkill River	Waples Pond @ Rt. 1	105	--	--	101	--	--	104	0	--
303341	Broadkill River	Pemberton Branch @ Gravel Hill Rd. (Rt. 30)	104	0.051	98	99	--	--	103	-0.2019	95
304011	Nanticoke River	Nanticoke River @ Sharptown	94	--	--	93	--	--	95	0	--
304151	Nanticoke River	Nanticoke River @ Buoy 66 (mouth of DuPont Gut)	97	-0.038	95	95	--	--	97	-0.216	--
304191	Nanticoke River	Nanticoke River @ Rifle Range Rd. (Rd. 545)	183	--	--	181	--	--	183	-0.1827	98
304311	Nanticoke River	Concord Pond @ German Rd. (Rd. 516)	104	--	--	101	--	--	104	0	--
304321	Nanticoke River	Williams Pond @ East Poplar St.	101	-0.063	80	100	--	--	102	0	--
304381	Nanticoke River	Bucks Branch @ Conrail Rd. (Rd. 546)	91	--	--	90	--	--	91	0	--
304471	Nanticoke River	Nanticoke River @ Rt. 13	102	--	--	100	--	--	102	0.2111	--
304591	Nanticoke River	Deep Creek @ Old Furnace Rd. (Rd. 46)				43	-0.007	90	43	1.162	98

Station	Watershed	Station Location	Total N count	Total N Trend	Total N Confidence	Total P Count	Total P trend	Total P Confidence	TSS Count	TSS Trend	TSS Confidence
304681	Nanticoke River	Nanticoke River @ Beach Hwy. (Rt. 16)	49	--	--	49	--	--	49	-0.2804	--
305011	Lewes and Rehoboth Canal	Lewes & Rehoboth Canal @ Rt. 1	105	--	--	104	--	--	106	-0.8797	98
305041	Lewes and Rehoboth Canal	Lewes & Rehoboth Canal @ Rt. 9	104	--	--	104	--	--	106	-0.6095	95
306091	Rehoboth Bay	Rehoboth Bay @ Buoy 7	80	-0.015	98	95	--	--	97	-0.8721	98
306111	Rehoboth Bay	Massey Ditch @ Buoy 17	87	--	--	104	0.001	90	106	-0.9137	98
306121	Indian River	Indian River Bay @ Buoy 20	102	--	--	116	0.002	95	119	-0.8166	95
306181	Indian River	Indian River @ Buoy 49 (Swan Creek)	95	-0.054	95	95	--	--	97	0.3747	--
306321	Indian River	Indian River Inlet @ Coast Guard Station	114	-0.016	98	123	--	--	125	-0.2767	--
306331	Indian River	Indian River @ Island Creek	96	-0.032	95	94	--	--	96	-0.6217	80
306341	Indian River	Island Creek upper third	95	--	--	93	--	--	95	-0.6645	80
307011	Broad Creek	Records Pond @ Willow Street	103	-0.045	95	101	0.001	90	103	0	--
307031	Broad Creek	Broad Creek @ Bethel Rd. (Rd. 493)	47	0.157	80	47	0.005	95	47	2.607	95
307081	Broad Creek	Hitch Pond Branch @ Pepper Pond Rd. (Rd. 449)	44	--	--	49	--	--	49	0.2381	--
307171	Broad Creek	Horse Pond @ Sharptown Rd. (Rt. 24)	98	-0.076	90	98	--	--	100	0	--
307371	Broad Creek	Raccoon Prong @	62	--	--	66	--	--	65	0	--

Station	Watershed	Station Location	Total N count	Total N Trend	Total N Confidence	Total P Count	Total P trend	Total P Confidence	TSS Count	TSS Trend	TSS Confidence
		Pepperbox Rd. (Rd. 66)									
308031	Rehoboth Bay	Burton Pond @ John Williams Hwy. (Rt. 24)	104	--	--	104	--	--	107	0	--
308051	Rehoboth Bay	Guinea Creek @ Banks Rd. (Rd. 298)	107	-0.104	95	104	0.001	80	107	-0.2523	80
308071	Indian River	Millsboro Pond @ John Williams Hwy. (Rt. 24)	143	-0.067	95	141	0.001	98	143	0.06214	90
308091	Indian River	Pepper Creek @ Main St. (Rt. 26)	109	-0.050	95	107	0.001	95	109	0.1428	--
308281	Indian River	Cow Bridge Branch @ Zoar Rd. (Rd. 48)	103	-0.076	95	107	0.001	90	108	0	--
308341	Indian River	Swan Creek @ Mount Joy Rd. (Rd. 297)	103	--	--	96	--	--	103	0	--
308361	Indian River	Blackwater Creek @ Omar Rd. (Rd. 54)	97	-0.133	95	97	--	--	99	-0.099	--
308371	Rehoboth Bay	Bundicks Branch @ Beaver Dam Rd. (Rt. 23)	94	0.212	95	94	--	--	94	-0.1164	80
309041	Iron Branch	Whartons Branch @ Dagsboro Rd. (Rt. 20)	107	-0.106	95	106	-0.001	95	107	-0.4364	95
310011	Little Assawoman Bay	Little Assawoman Bay @ Rt. 54 (The Ditch)	94	-0.023	95	106	--	--	109	-0.8528	95
310031	Little Assawoman Bay	Dirickson Creek @ Old Mill Bridge Rd. (Rd. 381)	100	-0.068	95	105	--	--	107	-0.9807	95
310071	Little Assawoman Bay	Little Assawoman Bay Mid-Bay (Ocean Park Lane)	98	-0.049	95	105	-0.002	95	108	-1.281	95
310121	Little Assawoman Bay	Beaver Dam Ditch @ Beaver Dam Rd. (Rd. 368)	124	-0.143	95	121	0.001	90	124	-0.1183	80

Station	Watershed	Station Location	Total N count	Total N Trend	Total N Confidence	Total P Count	Total P trend	Total P Confidence	TSS Count	TSS Trend	TSS Confidence
311041	Buntings Branch	Buntings Branch @ Fenwick Rd. (Rt. 54)	99	--	--	99	--	--	100	0	--
312011	Indian River	White Creek @ mouth of Assawoman Canal	103	-0.041	98	106	-0.002	95	108	-1.398	95
313011	Pocomoke River	Pocomoke River @ Bethel Rd. (Rd. 419)	97	--	--	101	--	--	101	0	--
316011	Nanticoke River	Gravelly Branch @ Coverdale Rd. (Rd. 525)	106	--	--	101	--	--	106	0	--
316031	Nanticoke River	Gravelly Branch @ Deer Forest Rd. (Rd. 565)	53	-0.036	80	53	--	--	53	-0.0384	--
401011	Delaware Bay	Roosevelt Inlet Mouth	99	--	--	109	--	--	--	--	--

2018
Delaware Nonpoint Source Program
Delaware Department of Natural Resources and Environmental Control